DESCRIPTION OF INVENTION

Name of invention: *NON-INVASIVE METHOD OF CARDIAC OUTPUT MEASUREMENT THROUGH ASSESSMENT OF SKIN THERMAL RESPONSE.*

Confirmation No 7349 for Provisional Application 07/11/2001 (copy is enclosed).

PROBLEM.

There are different measurable parameters in medicine, characterizing cardio-vascular system: blood pressure, pulse rate, cardiac output, stroke volume etc. Cardiac Output (CO) is considered the most important among them. It presents total amount of blood in liters(L) pumpted out by heart through circulation in 1 min. Under normal conditions CO=4 – 8 L/min and its amount depends on Body Surface Area (BSA, m2): the the larger BSA so the more CO should be. Besides CO is equal to Pulse Rate multiplied by the Stroke Volume,SV, the amount of blood in liters pumpted out by heart through circulation in one contraction. Usually SV is in close relation with the Pulse Pressure,PP, the difference between Systolic and Diastolic Blood pressures.

All existing techniques providing measurement of CO either precise but potentially risky for health or safe but expensive and imprecise. The method offered in this record is safe, non-expensive and non-invasive (i.e. through skin, without blood contact) way of CO measurement through assessment of the thermal response of the skin over artery by digital thermometer (Fig.1). This approach seems to be especially important today, when preventive health technology becomes a key factor of the health improvement through the world.

INVENTED PROCESS.

Experimentally if we could place a small cold solid object directly on the wall of large blood vessel it would be warmed after sometime. And the rate of its warming will depend on (i) temperature gradient between blood vessel and that object, (ii) size of that object and (iii) RATE OF THE BLOOD FLOW. Thus, through assessment of these thermal changes under steady-state conditions (i.e. constant inner temperature and size of the object) we can measure the rate of the blood flow and consequently the cardiac output.

Abovementioned experiment is impossible to be carry out in clinical situation. However, there are some parts of the human body, where artery passes so close to the body surface, that we can easy palpate arterial pulsation there (e.g. arterial pulsation on the front of the wrist) and we can expect different thermal body response on cold challenge over there in compare to other parts of the body. Aiming to combine *COLD STIMULI OF THE SKIN OVER ARTERY AND THE MEASURE OF THAT SKIN RESPONSE ON IT* I have used *THERMOMETER* itself as *COLD STIMULI* (Fig.1). Statistical evaluation of data, obtained in 26 volunteers allows to consider abovementioned **thermal response of the skin** over artery on exposure of cold thermometer as the **result of blood flow rate** within that vessel.

This thermal responsse of the skin (dT) has been in significant correlation with BSA (r=0,65, Fig.2) and PP (r=0,58, Fig3). The latter correlation increased upto 0,64 when dT was multiplied by BSA (Fig.4).
Proper application of well-known laws of thermodynamics with their corresponding formulas for the heat transfer with forced convection can allow to calculate the rate of the blood flow and consequently cardiac output. Similarly, simultaneous measurement of CO and dT in the group of patients can give the parameters of dT which couple with the corresponding data of CO.

K.K.T.C.
LEFKOŞA NOTERİ
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Enver Sedat Simavi

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